

proportion of the stutterers in the German schools, and, strange to say, is exactly the percentage worked out in some of the Eastern cities.

These children are backward children, backward to exactly that extent that they cannot keep up with their classes. A study and an understanding of some of the general principles of speech defects will enable us to understand this backwardness and to prognosticate the outcome. Every child has inherent capabilities; the normal child develops his without special help, the backward child must be studied as an entity. Of all the accessories to the development of the mentally weak, speech is more important than any other of the special senses and it is the one that we can most easily manufacture for him.

Before specifically studying the subject of prophyllaxis, I wish to say a few words as to the general etiology of speech defects. We have here no exception to the general rule that, given the causal elements, the treatment and cure is made very much easier. The empirical treatment of speech defects as carried on by hordes of advertising charlatans and others who have a superficial but no scientific knowledge of the subject may result in some permanent cures, but for the most part in only temporary ones. We have 300,000 stutterers in the United States. A fourth of them would recover of themselves without treatment, and this fourth is the percentage that makes the business of the guarantee cure specialist possible.

In this paper I will confine myself to but two forms of speech defects, so that what I am going to say will deal principally with the stutterer and the stammerer.

The clinical features of each case are so different that a definite typical type is hard to describe. The etiology of the trouble is equally complex. The temperament of the child is one of the principal predisposing causes. A phlegmatic child very seldom stutters; the picture is always of an easily excited and nervous individual.

The nervous temperament may be inherited from the parents. The direct inheritance of stuttering itself is very seldom, in fact some writers believe that it does not take place. This view is a bit radical and not supported by cases which have been reported by both Gutzmann and Cohn.

It is a common belief that weak-mindedness is a potent cause of stuttering. Such is not the case; in fact, the stutterer is usually up to the average or a little better than the average child. It is not on account of their stupidity that they are always two years behind the normal child, but because their physical infirmities make it impossible for them to keep up. The complete imbecile does not speak at all, the half imbecile stammers, but we very seldom indeed find a stutterer among them. In the Dalldorf Institute for Idiots, among 224 children 36% stammered, but only 7 children or 3% stuttered.

In contradistinction to these predisposing causes which we have just mentioned we have causes which depend upon the environment and which are to be spoken of later. We will show that during the school period the number of stutterers is almost tripled. At the time of the second dentition and at puberty the percentage takes a sudden leap upward.

The same thing applies to the time of puberty. Here we are apt to find stuttering developed where it was never before ever suspected. It is a time usually when the child is studying hard. In our American life, on account of social conditions, the boy begins to go out to parties and dances. His day is all too short and his hours of sleep are cut down. The nervous system is in a more or less unstable condition and it is not to be wondered at if the previous tendency to nervous disquiet is accentuated and we have a stutterer develop as a result.

We must never forget that when the child enters school at the age of six he may not be a stutterer in the ordinary sense of the term, but he will have a tiny tendency that way that the vigilant teacher will recognize as a slight, a very slight, deviation from the normal either in the pronunciation of the words, in a slight hesitation over certain words or in a slight embarrassment in speaking. Here is where the teacher, if he could but have his attention called to this subject, could be of inestimable value to the child and to his future life. By the closest observation, with some sort of an idea of what to look for, he would be able to recognize preliminary symptoms such as beginning changes in the breathing, repetition of initial vowels or consonants, etc., even sooner than the child's parents. In school the environmental conditions are entirely different from those at home. Here the child is ever afraid of the shame

(Continued in February.)

MECHANICAL EFFICIENCY.*

By JAMES T. WATKINS, M. D., San Francisco.

The purpose of the group of lectures of which this is one is to give you some insight into the art, or as it is fast becoming, the science of right living; right living especially as it applies to yourselves and to your charges. In my own lecture I shall briefly direct your attention, first, to what we have come to regard as the state of maximum efficiency of the human body. I shall then dwell upon conditions which are essential to this state of well being. Finally, I shall discuss some of the commoner causes of physical inefficiency. Such a study is peculiarly the function of that branch of the healing art called orthopedic surgery. While the latter used to be defined as that specialty which deals with the prevention and cure of deformities, to-day its scope has become broadened till it might properly be described as "Scientific Management" applied to the human body. To certain aspects of this subject, it is my privilege at this time to direct your attention.

More than anything else the human organism resembles a delicately balanced machine, which is called upon to perform work whose character varies in inconceivably many ways and degrees. Work of the higher mental processes, work of the viscera, work of the muscles, has to be performed under constantly varying conditions and constantly changing speeds.

When the several parts are working rightly, there is a minimum of friction, and the efficiency of the individual is at its maximum. We call this condition perfect health. Any departure from this state of correlation, increases strain or friction, wastes energy and, by just so much, lessens efficiency. No

* An address on Orthopedic Surgery, delivered before the Teachers of the San Francisco Public Schools.

one part can be strained without affecting the whole.

For esthetic reasons the posture of selection in the upright position has long been recognized as that in which the individual, without standing on tip toe, can make himself as tall as possible. Head erect, chin in, shoulders thrown back, chest high, abdomen flat, spine slightly concave forward in the region of the thorax and slightly concave backward in the lumbar region; the pelvis being tilted forward so that its axis makes an angle of 60 degrees with the horizon.

A broader comprehension of anatomy and physiology has now taught us that this is also the attitude of greatest efficiency. In this position, the normal individual is able to stand with the least muscular strain, and from it he is able to move in any direction with the least muscular effort. Speaking more specifically, not only the muscle groups which dominate the head, but those which attach the arm to the body, are under slight but not fatiguing tension; the same thing being equally true of those controlling the trunk and lower limbs. Raising the chest has deepened it; thereby giving more room for the ex-

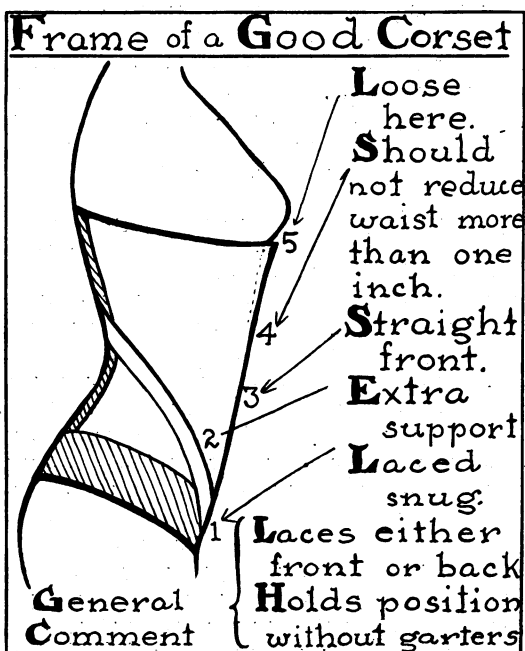
tion of the anterior abdominal wall. This last fact must make clear to one how important is the need of a firm abdominal musculature, how harmful whatever may tend to weaken the abdominal muscles.

My description would be incomplete did I not direct your attention to the mechanism by which we stand without muscular strain. Normally when we stand erect the leg rotates outward through a vertical axis on the foot partially locking the ankle joint; and at the same time the thigh rotates inward on the leg locking the knee joint. The center of gravity of the trunk lies behind a line connecting the hip joints; the consequent tendency of the trunk to rotate backward about this axis causes the heads of the thigh bones to be crowded against the strong Y ligaments which form the anterior boundaries of these joints. While a slight physiological tension of the muscles surrounding all of these joints is present, nothing like muscle strain is felt. If on the other hand because of any condition like for instance pronated foot, which is the first stage of "flatfoot," the locking at ankle, knee and hip does not occur, the leg must be held erect upon the foot, the thigh upon the leg, and the trunk upon the thigh, by the exertion of undue muscular force. And as a consequence of this strain, we commonly have pains referred either to the foot, the calf, the posterior and outer side of the thigh, or to the back. I shall discuss the causation of distortions of the foot more fully later.

The causes of deviations from the normal posture of maximum efficiency are to be seen in defects of many organs. Vicious postures of the head may be due to such congenital causes as wry neck, or to defects in the shapes of the joints of the occipital bone with the atlas, the vertebra which supports the head. Occasionally there may be a paralysis of some of the muscles controlling it. The most frequent causes, except muscular weakness, are defects of vision, especially astigmatism. Occasionally defects of hearing are responsible.

Deformities are either congenital or acquired. The former are comparatively rare. Their interest, from the point of view of the eugenicist, lies in the fact that they are likely to be reproduced in at least some of the patient's offspring. Acquired deformities, on the other hand, hardly ever reappear in the children.

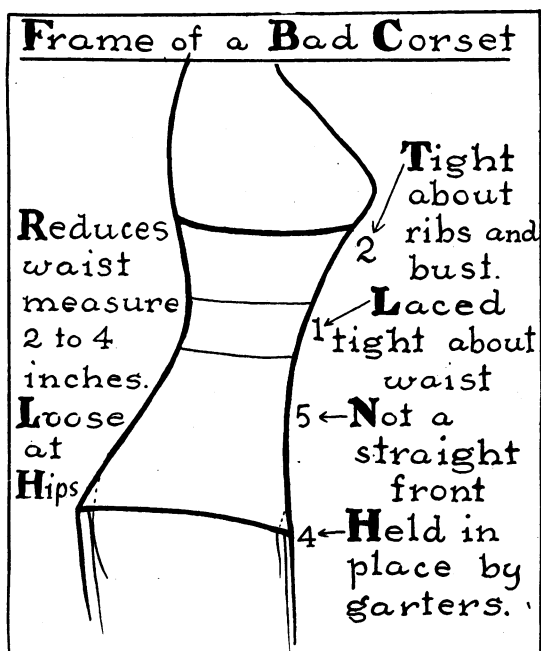
In thinking of deformities, especially of those which are not the result of injuries, you must remember that they usually represent the extreme of some normal motion. For example, each of us can voluntarily cause his foot to assume the turned-in position which we recognize as "clubfoot." The main difference between ourselves at birth and a clubfooted baby is that we can cause our feet to recede from the clubfoot position and he can not. If this baby now proceeds to use his foot while it is in this distorted position the bones will undergo definite changes in shape and size, the result being a permanent deformity. This brings me to the enunciation of a law, viz., that *deformity is the result of improper function*. If you should fix my foot in the clubfoot position and require me to walk on it that way for some months, as a result of this improper function, I would have a permanent deformity, a true clubfoot.



pansion of the lungs and movements of the heart. At the level of the third lumbar vertebra—a little above that of the umbilicus—the abdominal cavity is so narrow from before backward that, in this plane, it scarcely constitutes more than one-third of the thickness of the body. From here it slopes rapidly upward and backward, increasing in all diameters. Below this level the cavity is small, and is filled up with loose folds of the small intestine. The sharp inclination backward of the pelvis causes the upper end of the sacrum and its superimposed muscles to form a shelf which shields the pelvic contents from the pressure of the viscera above.

There is not space here to detail the mutual relations of all the abdominal organs; it must suffice to say that *when the body is erect* the various viscera rest upon ledges or shelves, formed, for the most part, by portions of the abdominal walls; and what downward thrust they exert is received by the lower por-

Spinal deformities are congenital or acquired. Sometimes one of the vertebræ is incomplete. Instead of being a cube, a vertebra may be triangular in shape, one-half the body being lacking. In that event, all the vertebræ above it deviate from the vertical, and in trying to return to it, form one other of the varieties of spinal curvature. Usually spinal curvature is acquired. Because of defective teeth, for example, a child has poor digestion. This, in turn, produces, among other evidence of malnutrition, weak muscles. These tire easily—especially under the strain of postures induced by ill-fitting schoolroom furniture—and children no longer sit up straight but slouch forward, hanging, as it were, on their ligaments. Now, if I bend forward and to the side, my spine will assume a certain posture which is the extreme of normal motion in these



directions. If I maintain this posture for a sufficiently long time, a portion of the spine loses its mobility and becomes fixed. When I attempt to straighten up the fixed portion will remain bent, even though the portions of the spine above and below it do not, and I shall present one form of that condition which we recognize as spinal curvature. That is, it represents the extremes of two normally present motions which, in the affected segment of the spine, have become fixed. I may add that spinal curvature cannot occur except in flexion and side bending.

It at once becomes manifest as our duty to require our charges to maintain the erect posture at all times. It is no less manifestly our duty to make it possible for them to sit up straight by giving them seats and desks at which they can sit erect without strain. Large men always look and feel uncomfortable on small chairs, and small men get lost in big ones, but it has not occurred to our predecessors that large and small children might do the same thing. That is, we standardized our schoolroom furniture without being able to standardize our children. I shall never forget the backaches I had

thirty years ago, down in the old Washington Grammar School.

Perverted ideas of the esthetic in matters relating to personal adornment are responsible for by far the greatest number of bodily distortions; though some physical defects are the consequence of theories of dress based upon mistaken ideas of anatomy. As an example of the second group, I would recall to you the fallacy that a growing child's clothes should hang from the shoulders. All the varieties of ready-made children's waists are designed with this idea in mind. Yet if you will look for an instant at the skeleton of the shoulder girdle you will recognize that this contention must be erroneous. For its only bony attachment to the trunk is at the inner end of the clavicle, or collarbone. Elsewhere it is attached loosely by muscles. Further the ribs upon which the scapula, or shoulder-blade, rests slope downward and forward so steeply that any pull or thrust upon the point of the shoulder must cause it to slip downward and forward to assume the posture which we recognize as "round shoulders"; while the posterior edge of the shoulder-blade projects backward as a sort of angel's wing.

You will recall that a Chinaman can carry all day long two great baskets slung on the ends of a pole—baskets so heavy that most of us could not lift them. You will further recall that he does *not* balance this pole on the *end* of his shoulder: on the contrary, he centers it as nearly as possible on the spine, through the short ribs at the root of his neck. Centuries of drudgery have taught him what a study of anatomy will teach you, namely, that weights, including that of clothes, may be supported here, at the root of the neck, with the least disturbance to the poise of the individual.

When I was a student of medicine a strange mistake had crept into the text-books on physiology as a consequence of the misinterpretation of observations made on persons who were the subjects of certain dress distortions. I was taught that the respiration of men was essentially different from that of women. Outline illustrations were pictured showing that masculine respiration was essentially abdominal in type and caused by the rise and fall of the diaphragm, whereas that of women was thoracic and due to the ascent and descent of the ribs. We were told to wonder at the wisdom of Mother Nature. She made a woman breathe above the waist because it would not do to disturb the abdominal organs of an expecting mother, whereas a man was permitted to breathe after the manner of the lower animals.

Just as I was at the height of my admiration for Mother Nature's methods, along came one Kellogg. With an instrument called a sphygmograph, he took tracings which showed conclusively that Indian and Oriental women, expecting mothers as well as maidens, breathed exactly as men did; that men, when put into corsets, developed a thoracic type of breathing identical with that of women; and, finally, that women who had been addicted to corsets, but had broken off this habit, acquired a type of respiration more nearly abdominal than thoracic.

The corset is an institution of too venerable an antiquity for me lightly to speak disrespectfully of it. Nor would I venture to ask any one of my

hearers who might perhaps have acquired the habit in early youth to disregard the fiat of convention by discarding it now. Further, I am prepared to agree that some corsets are very much more injurious than other corsets. But I would lay before you certain facts, and to your inevitable deductions I would add some of my own based upon professional experience.

We know that when one is confined to bed from any cause, one's muscles become quickly and progressively weakened. We know that when an arm, for instance, is confined in a plaster cast it "withers," as the saying is, that is, it atrophies. Further, and conversely, we know that the development of a part implies its use and some proper exertion in its use.

Primarily, corsets were hammered out of iron by the castle armorer, and worn with more fortitude than wisdom by the chatelaine for their cosmetic effect. They emphasized the fact, so to speak, that women were not men—which was the most that was demanded of their wearers in those days. To-day they constitute a support for the lower thoracic and for the abdominal walls and, besides impeding the descent of the diaphragm—hence the thoracic respiration before mentioned—they splint and consequently must and do weaken the abdominal musculature. But we saw a while back how absolutely essential to scientific management of the body was a vigorous set of abdominal muscles. In this way a corset may be said to make directly for functional inefficiency on the part of the wearer. When I was a student in Europe, I recall seeing women who worked all day in the fields and yet other women who, as hodcarriers, climbed up and down ladders for four and five stories all day long, carrying loads of bricks or mortar. In Japan young girls coal the great ocean-going steamships. Between them all they refute absolutely the idea of woman's physical inferiority—but these women do not wear corsets. It is a matter for recurrent comment among medical men with what relative ease barbarian women give birth to their young. No small part of the distress experienced by their civilized sisters may be attributed to the fact that, through weakening of their abdominal walls by corset splinting, their expelling power has become largely dissipated.

Finally, I wish to remind you that while men occasionally come to the operating-table, it is upon women that the abdominal surgeons fatten and grow rich. How often do you hear of a man having a floating kidney, or an enteroptosis, as sinking down of the abdominal organs is called? On the other hand, are you not forever hearing of women who have them? I am. And why is this? Is it not because the abdominal walls of women have been relaxed and rendered mechanically inefficient—have, like the arm in the plaster of paris cast, become *withered* by the compression and support of the corset? Why, if abdominal surgeons had a spark of appreciation in them, they would erect a monument to their true and tried friend, the ordinary corset!

Now, it is not for you nor for me to discard our defective dress. In us the mischief has been done. Already our organs either float or sink. I doubt if most of us could get along without these things. Ephraim is indeed wedded to his idols! Nevertheless, we should frankly and openly bear witness

to the errors that we have made ourselves—or that our parents have made for us—so that those who come after us may profit by our sad experience. If you can only succeed in persuading adolescent girls that to put on corsets does not transform them into women nor render them more adorable, but may indeed be the beginning of things which make for invalidism, you will have done much toward increasing the happiness of the next generation of women and, at the same time, irreparable injury to the next generation of doctors.

I said a moment ago that some corsets were much more injurious than others. The least harmful type of corset is that which takes its support from the pelvis and can keep its place without the aid of garters or straps. It has a strong upright upon each side of the spine which follows the curves of the body behind. The front is straight. It must not decrease the normal waist measure more than one inch. At its upper border it should be slightly larger than the body at this level. The lower or pelvic portion, which is not more than a handbreadth reaching from the iliac crests to the upper surface of the trochanter, or prominent upper end of the thigh bone, should be laced with an independent lace. Tight lacing should be confined to this portion. The mischief done by such a corset will be confined to the weakening, through splinting, of the abdominal muscles. It will not cause displacements of the viscera.

Distinctly harmful, however, is the type of corset which is held in place by being cinched about the waist. It constricts the waist sometimes as much as four inches. It is tight about the ribs and bust, loose about the hips, and is kept from riding up by garters. Instead of a straight front it has one which slopes in toward the waist from above and below. Such a corset will not only injure the abdominal musculature but bring about permanent and pathological dislocations of the thoracic and abdominal viscera.

It would seem that man began to decorate his feet as soon as he found that their unimpeded use was not essential to the struggle for existence. The Egyptian statuary shows normal feet, but we know that it was required to conform to a strict convention. We also know, however, that the Egyptians wore pointed shoes. The deduction is inevitable that their feet must have followed the moulds in which they were encased and must have, therefore, been correspondingly deformed. No people have ever studied dress with a view both to efficiency and also to preserving the symmetries of the human form, as did the Greeks. Yet even the Hermes of Praxiteles shows an abnormal deviation outward of the four outer toes, caused by the thong of the sandal which passed between the second and great toes. From the Dark Ages civilization emerged saddled with all manner of dress deformities, some of which, like our old friend the corset, obtain in modified form to the present day. You will recall that Scott, in his immortal description of the Field of Ashby de la Zouche, says that Prince John wore shoes, whose pointed toes were attached to his knees by gold chains. "The Golden Lilies," as Chinese poets have called the bound feet of their women, are, it

appears, a matter of no great antiquity. So much for evidence that the tendency to decorate feet is as universal as it is ancient.

Now again remember, I am not asking *you* to wear square-toed shoes, nor to discard high heels, nor to do anything except to seek out that last in which your individual feet find comfort and act well. The time when your feet and mine could have been made anatomically perfect is past. By proper orthopedic treatment they can be relieved of disabilities, but anatomically perfect they cannot ever become. Dr. Blodgett, an orthopedic surgeon of Boston, reported that among one thousand persons who had presented themselves with defective feet, all, or almost all, had been relieved of their disabilities and not in one instance had a defective foot been made into a normal foot. Distorted feet cannot be cured, they must be prevented.

Ideally shoes should be made over individual lasts; this is however especially with growing children, not practicable. I have therefore selected several types of commercial shoe which have, in my experience, most often proved satisfactory. Frequently one has to take one of these shoes and modify it to meet the needs of the individual. This, like plate fitting, can of course only be done by one trained to the work. One of the most lucrative features of orthopedic practice is the correction of ailments which have been aggravated by shoe-store fitted plates.

Little growing children should wear loose, non-shrinkable stockings and shoes made on the sandal type of last. I prefer low shoes to high, since the so-called "uppers" tend to check the up and down motions of the foot on the leg. That "uppers" support the ankle is a fallacy. An ankle which is so weak that it cannot be balanced and must be supported, calls for a bar up the side of the leg. The "upper" merely conceals the distortion in these cases. It has not leverage enough to correct it.

The proper shoe is that whose insole corresponds with the outline imprint on paper of the stockinged foot, but has a somewhat longer toe. Its inner border should be higher than its outer, just as the inner border of the foot is higher than its outer border. The joints where side to side motions are made occur rather more than three-fifths of the way from the toe to the heel; therefore the shank of the shoe should be short. A long narrow shank would splint the foot and side to side motions would be impossible. The heel should be broad, advanced well under the instep, and high or low according to the character of the individual foot. Of course, in the really normal foot no heel is needed; but we do not get really normal feet. This is neither the time nor the place for me to enter into an exhaustive discussion of defective feet.

Here and now I can only tell you that every child who "toes in" is either wearing too short a shoe or is trying to save his arches by contracting the muscles at the inner sides of his feet; every child who "runs over" his or her shoes, who shifts from one foot to the other, who stands with the legs far apart, or with the knees locked, who persistently leans up against the furniture during recitation, who regularly walks with a shuffling, springless gait, con-

sciously or unconsciously, is a sufferer from weak feet, and is in need of proper medical attention. Weak feet are not always manifested by symptoms directly referable to themselves. Lately I submitted to the Academy of Medicine a report on the following unusual cases:

One patient, where the end of the back, the so-called os coccyx, had been removed for symptoms typical of disease of that region, "coccygodynia" it is called;

One lady who had been subjected to capital operations for backache;

One man suffering with painful knees;

Two young women who had been supposed to have hip trouble; and

Two men who were said to have disease of the spine.

All of these patients were shown to have defective feet, and though the feet themselves had at no time presented subjective symptoms, treatment of this foot condition gave relief from the other and apparently dissociated symptoms. I merely cite these cases to show you how important a matter really is the hygiene of the feet.

I think that on reflection my purpose in this paper will be apparent to you. The whole trend of modern thought is toward economy. Economy of natural resources, economy of time, economy of labor. "Scientific Management" it has come to be called. Here I have attempted to show you as briefly as might be, how scientific management applied to the employment of that most complex of all machines, the human body, and to suggest to you some of the kinds of ways in which its usefulness might be hampered by unscientific management. Against these you should unceasingly be upon your guard.

To those who will apply the principles suggested, a new field of interesting speculation and observation will open up. The study of eugenics is as yet in its infancy. Many problems, which have not here been touched upon, will spring up to perplex you. But in seeking to solve them, you will yourselves attain to a higher intellectual level.

Remember always that you are, yourself, not an imitator, but an original observer, and your own original recorded observations in this field of endeavor will add something to the sum of human knowledge, will accomplish somewhat to the uplift and betterment of the race. For to no one who seeks it humbly is the truth ever wholly hid.

350 Post Street.

A CASE OF BROWN-SEQUARD'S PARALYSIS FOLLOWING A STAB WOUND OF THE BACK.*

By W. W. RICHARDSON, M. D., Los Angeles.

Case—R,—Age 33, Male, Single—Mexican.

Diagnosis: Hemilesio medullae spinalis.

History: On the evening of Oct. 1, 1911, he was stabbed repeatedly in the back with a knife. He fell to the ground and has not walked since. He says that he noticed shortly after the injury an

* Read before the Los Angeles County Medical Association, November 17, 1911, with presentation of the patient.